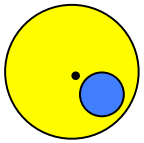
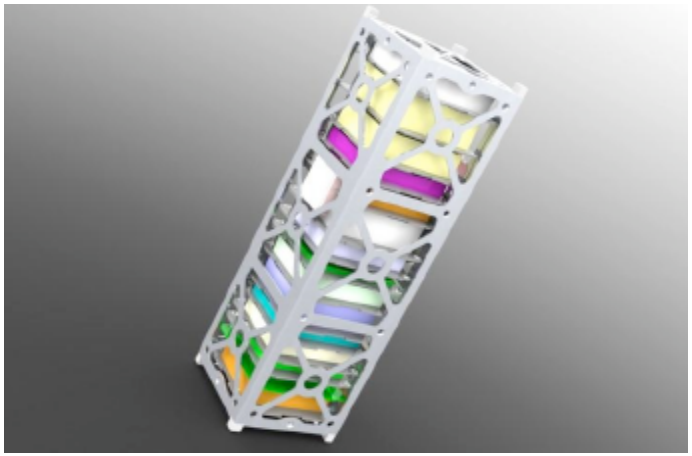


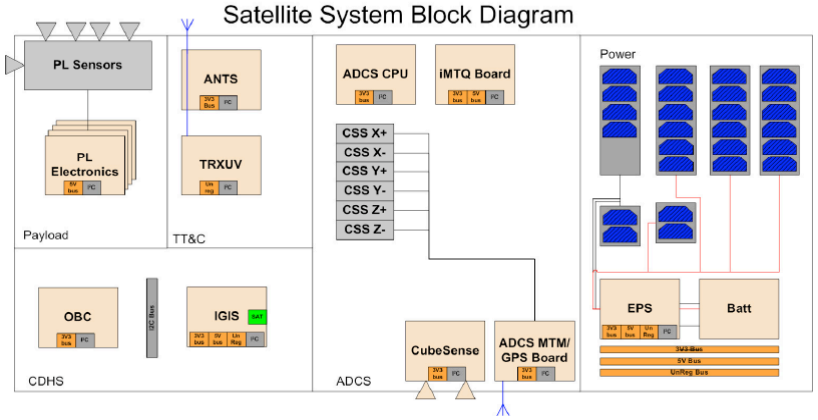
SIMBA the nanosatellite : the Sun-earth IMBAlance radiometer

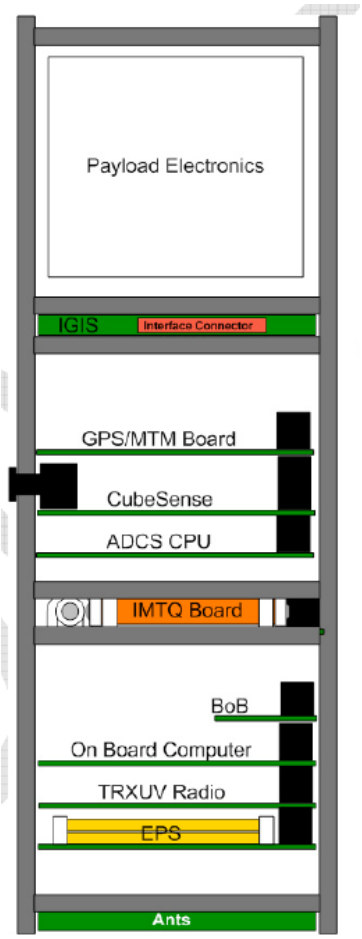
Steven Dewitte

SIMBA

3 Unit cubesat







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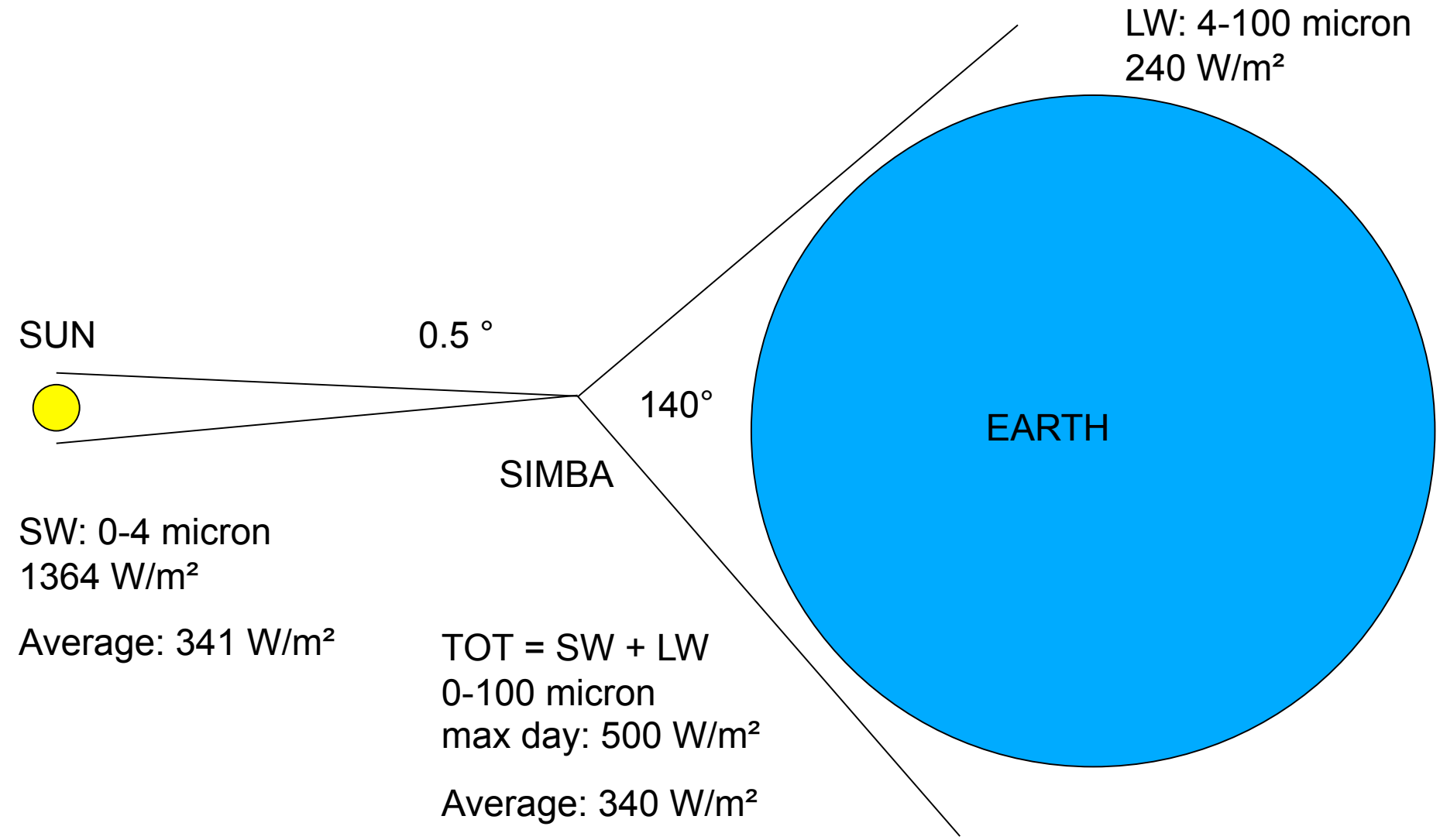
Sun – Earth measurement



Science goal 1

- Continue measurements of long term Total Solar Irradiance observations
- Importance: Essential Climate Variable
- How: make solar measurements with cavity radiometer
- Heritage: DIARAD type radiometers

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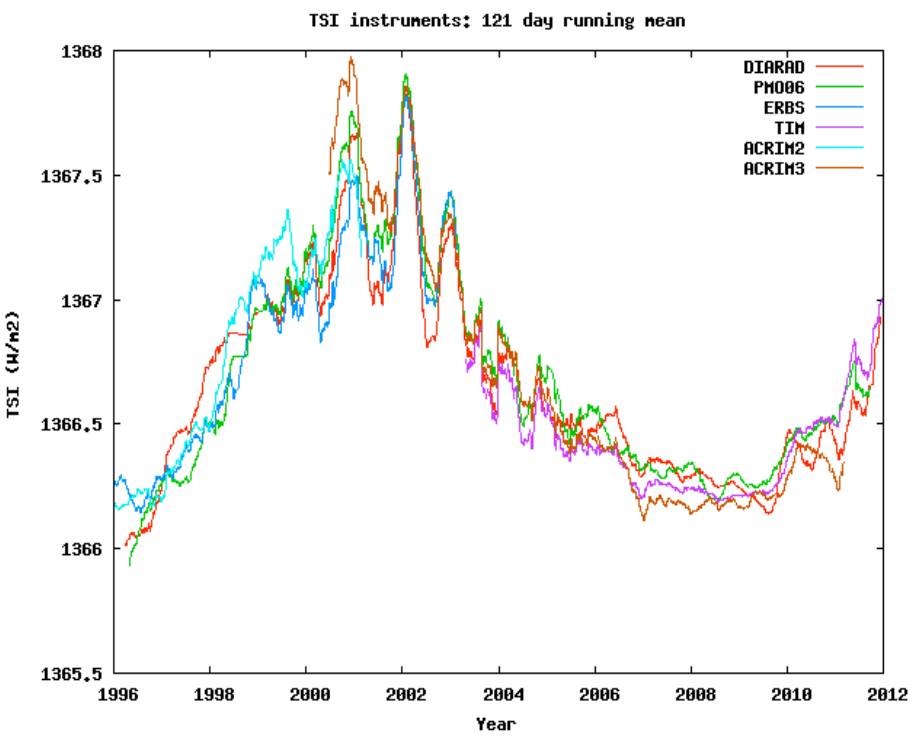
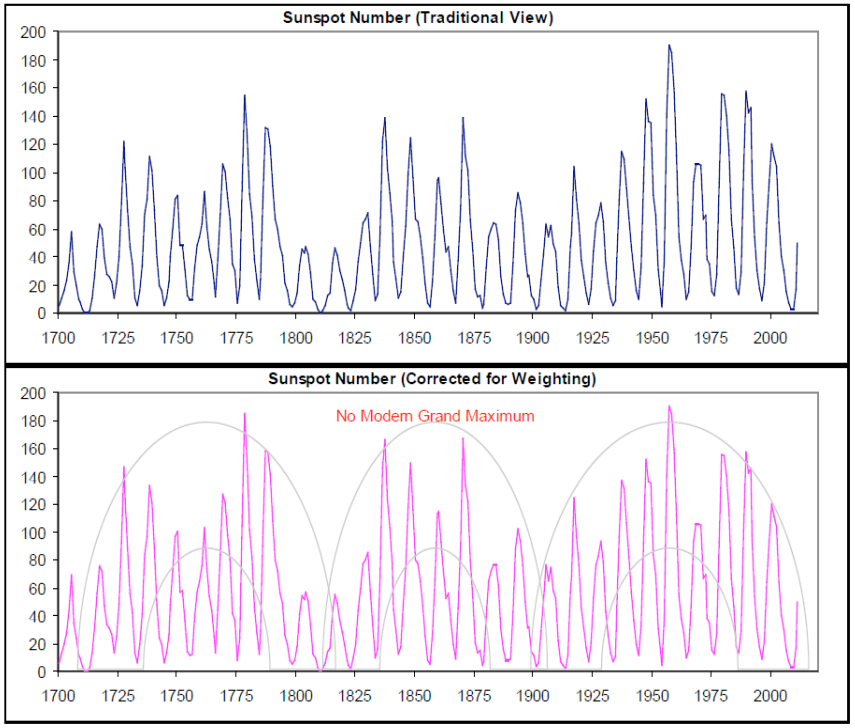
Cycle 23+24 TSI variations





Science goal 2

- Improve knowledge of the TSI absolute level: the solar constant
- Importance: THE radiometric reference measurement
- How: cavity radiometer with improved design: no baffle, good spatial uniformity + aperture measurements + pre-flight ground comparison with cryogenic radiometer
- Heritage: DIARAD

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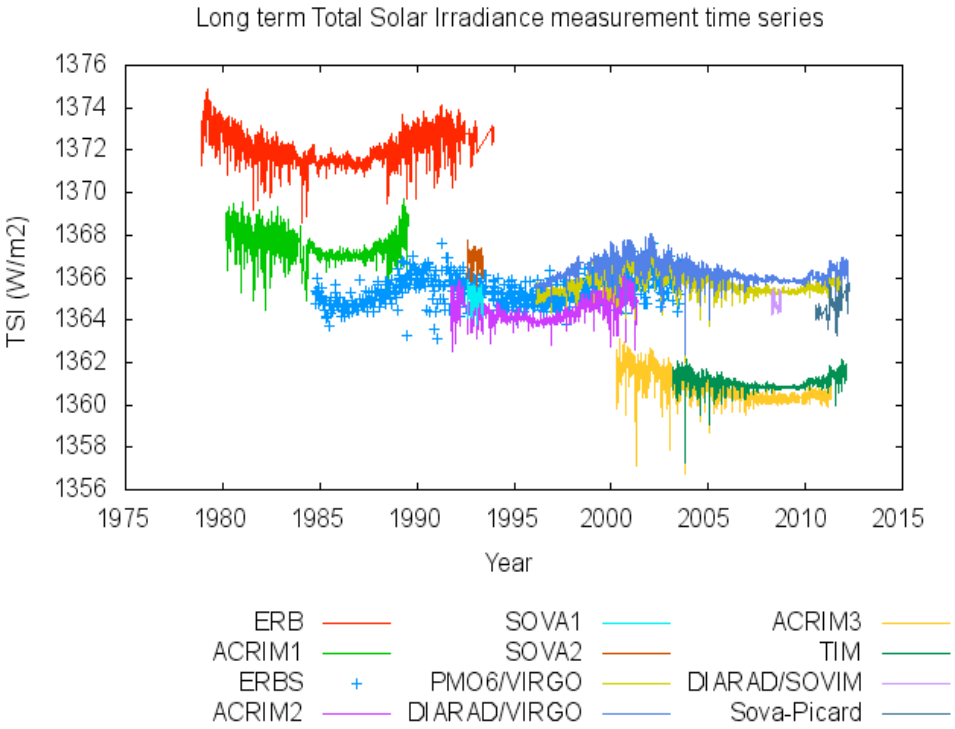
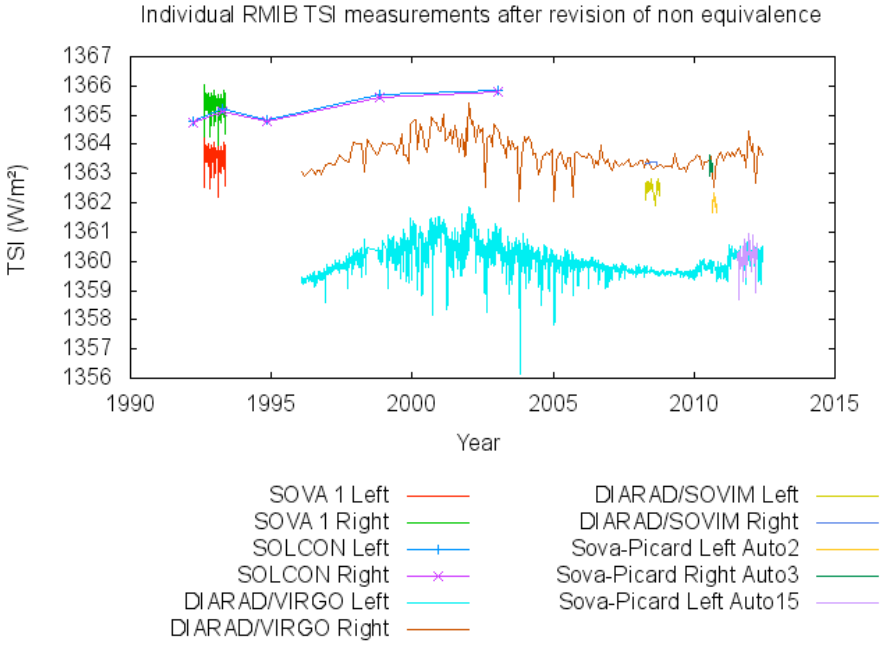

Long term Total Solar Irradiance measurement time series
TSI (W/m2)
Year
1376
1374
1372
1370
1368
1366
1364
1362
1360
1358
1356
1975
1980
1985
1990
1995
2000
2005
2010
2015
ERB
ACRIM1
ERBS
ACRIM2
SOVA1
SOVA2
PMO6/VIRGO
DIARAD/VIRGO
ACRIM3
TIM
DIARAD/SOVIM
Sova-Picard

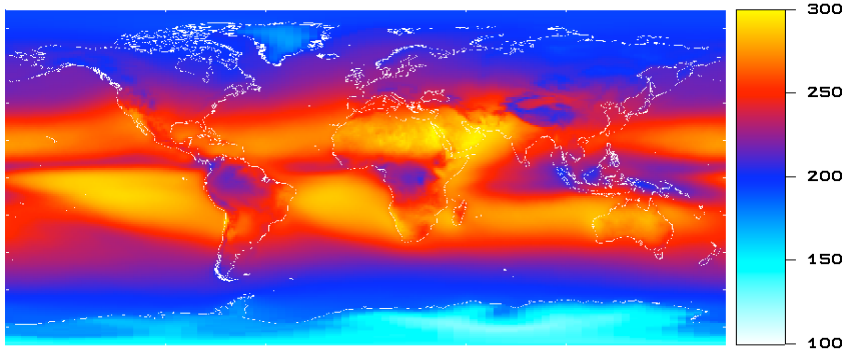

Individual RMIB TSI measurements after revision of non equivalence
TSI (W/m²)
Year
1367
1366
1365
1364
1363
1362
1361
1360
1359
1358
1357
1356
1990
1995
2000
2005
2010
2015
SOVA 1 Left
SOVA 1 Right
SOLCON Left
SOLCON Right
DIARAD/VIRGO Left
DIARAD/VIRGO Right
DIARAD/SOVIM Left
DIARAD/SOVIM Right
Sova-Picard Left Auto2
Sova-Picard Right Auto3
Sova-Picard Left Auto15

Science goal 3

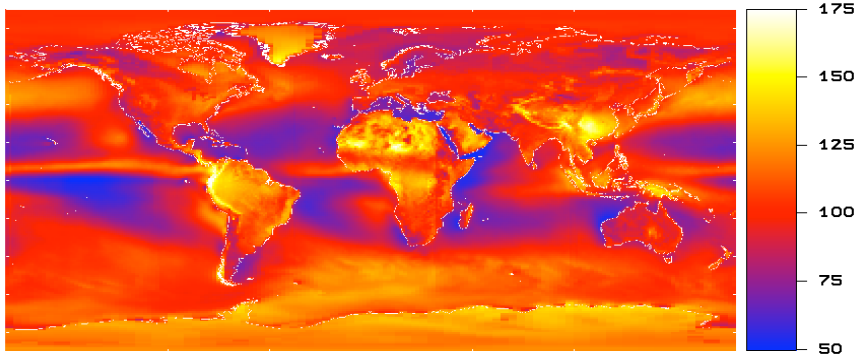
- Continue Earth Radiation Budget measurements
- Importance: Essential Climate Variable
- How: measure Total and Shortwave/ Longwave radiation with cavity radiometer
- Heritage: GERB, NASA ERBE WFOV, NASA CERES, BOS

Earth radiation (annual mean)

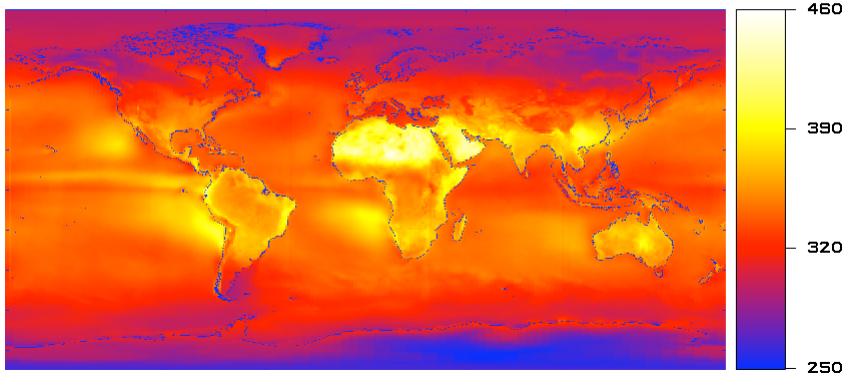
W/m²



Emitted thermal



Reflected solar



Total outgoing

Science goal 4

- First ever measurement of the Earth Radiation Imbalance
- Importance: driver of climate change
- How: accurate intercomparison of incoming solar and outgoing terrestrial radiation with single cavity radiometer

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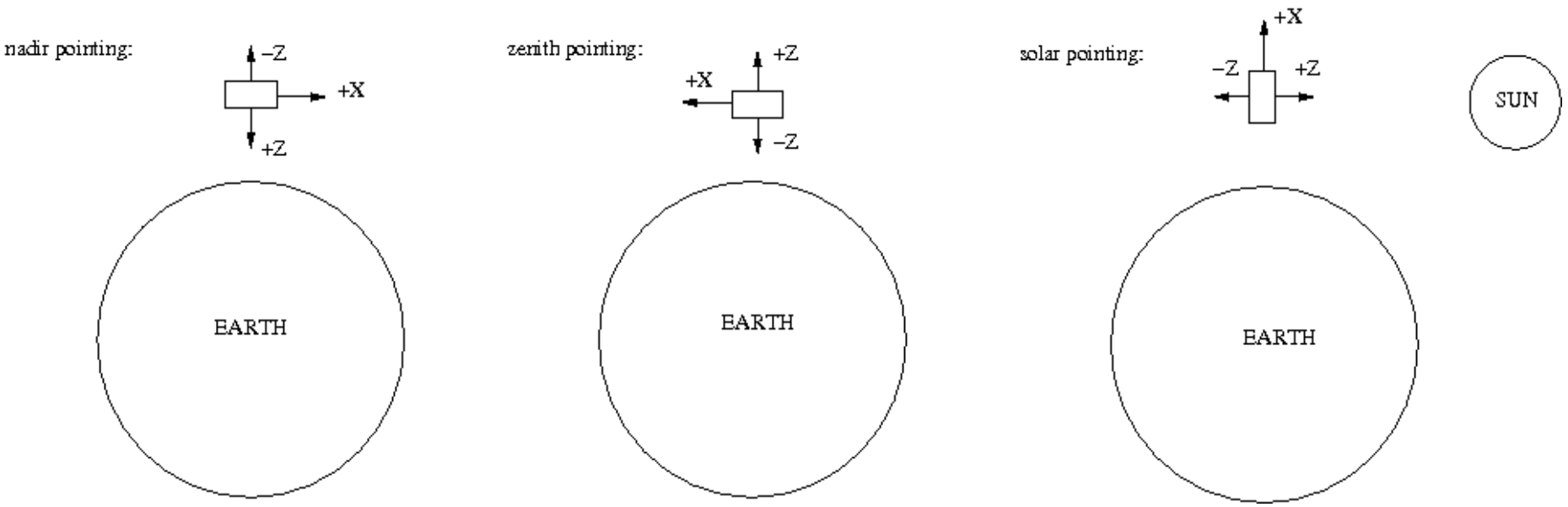
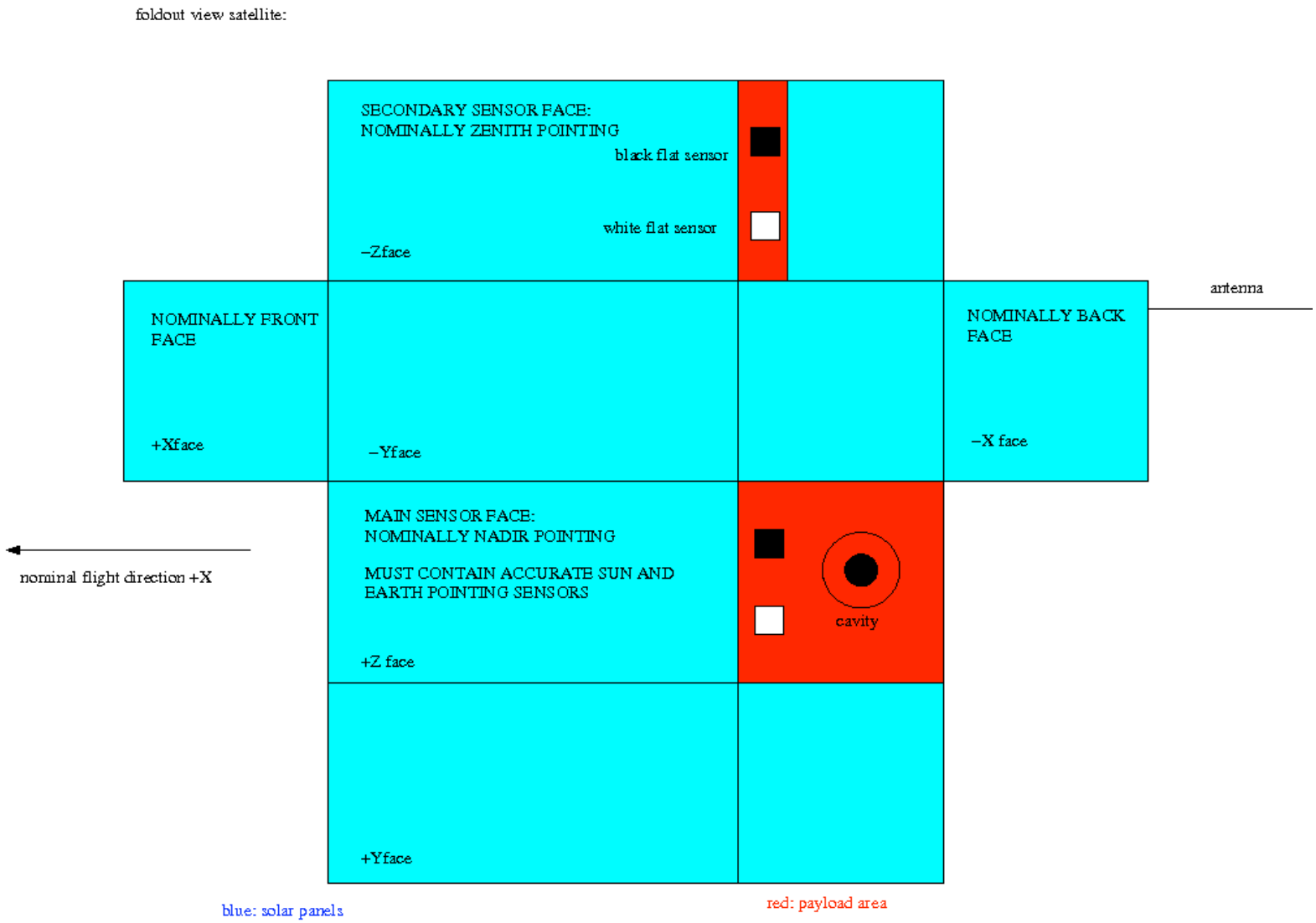
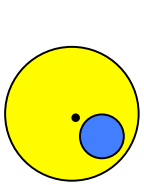
Pointing modes



Foldout view





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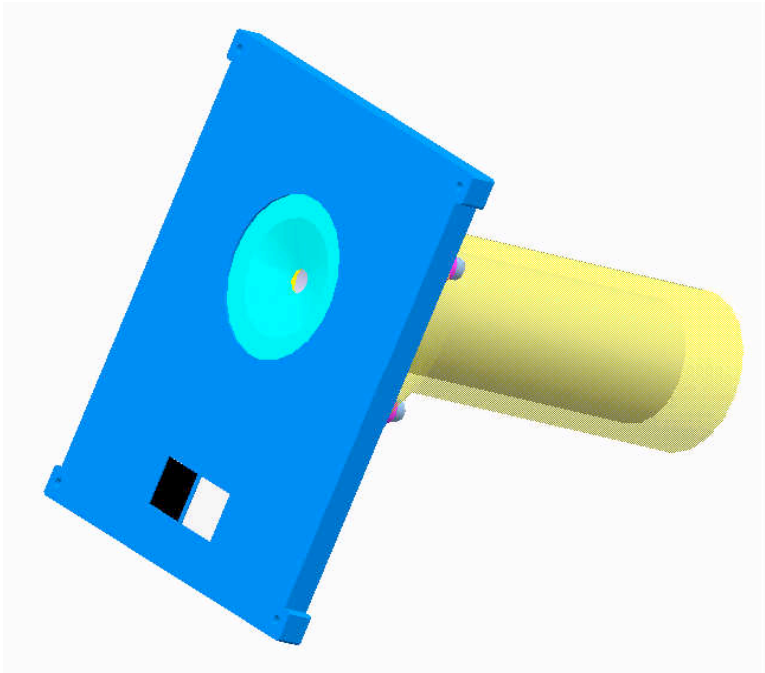
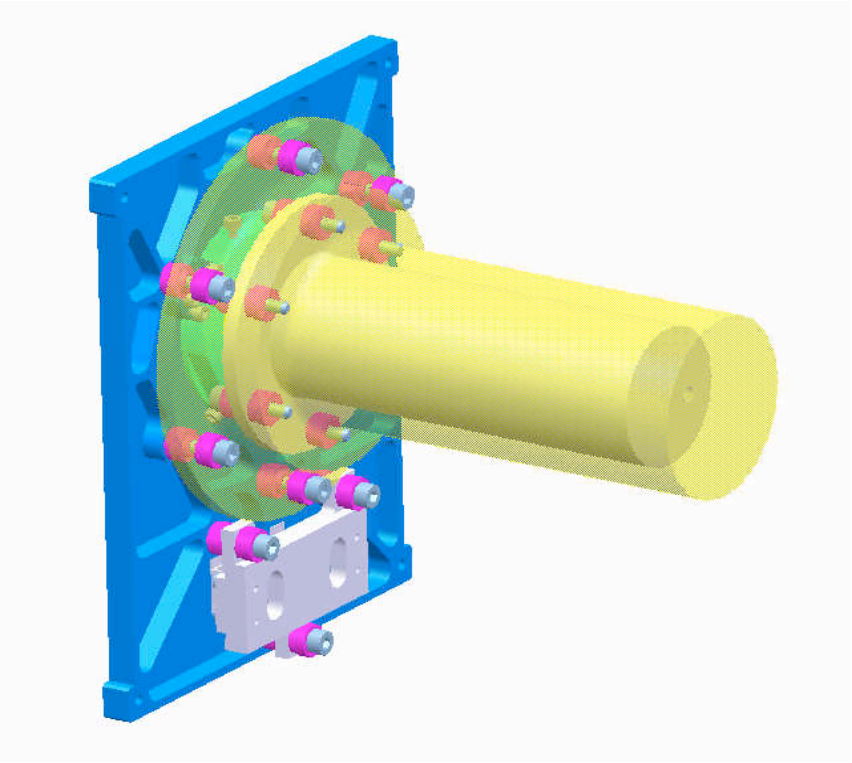
Instrument design





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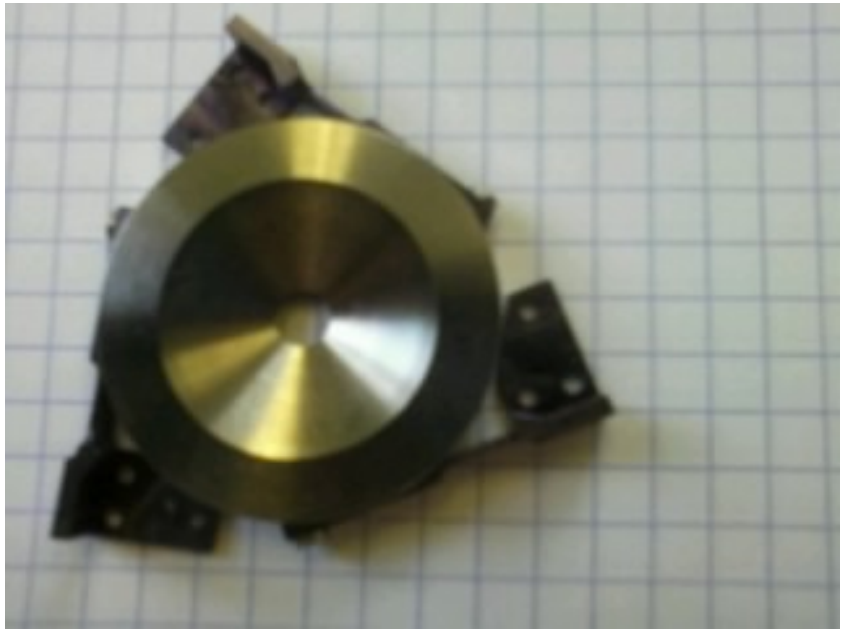
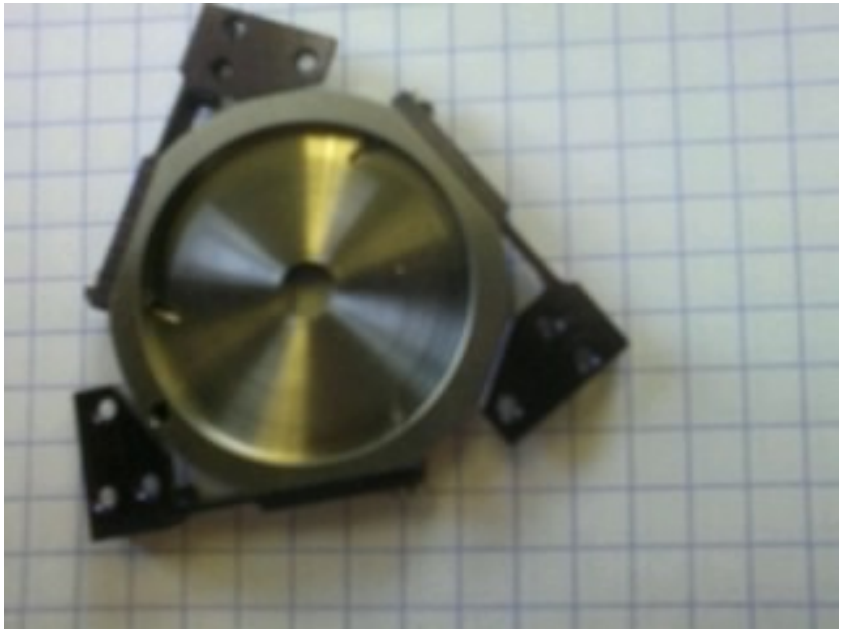
Aperture





Current status

- QM cavity main mechanical parts constructed, surface treatment ongoing
- Testing electronics principle and noise measurement
- Satellite mechanical structure purchased
- Electrical Power Supply ordered
- Open ITT's: ADCS system, radio communication, solar panels
- To be ordered: On Board Computer, Command & Data Handling Software

Conclusions

- SIMBA: fast development, low-cost nanosatellite for measurement TSI & ERB
- Components to be ordered by end 2012
- Satellite ready end 2013
- Launch early 2014
- Open for collaboration

SIMBA team

Royal Meteorological Institute of Belgium : lead institute

- **Steven Dewitte: Principal Investigator**
- **Andre Chevalier: Project Manager**
- Christian Conscience, Sami Bali, Joel Pierrard, Pierre Malcorps: instrument realisation
- **Els Janssen**, Sabri Mekaoui: **instrument science**
- Nicolas Clerbaux : Earth Radiation Budget science

CoIs from partner institutes

- Mustapha Mefta, Abdenour Irbah, LATMOS
- Gaetan Kerschen, Amandine Denis, ULG
- Ozgur Karatekin, ROB
- Jan Cornelis, Hichem Sahli, Jonathan Chan, VUB